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EXAMINER

LAZORCIK, JASON L

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1731

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Please find below and/or attached an Office communication concerning this application or proceeding.

Continuation of Attachment(s) 6). Other: IDS Filed; 01/27/2005,05/24/2006.

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of the subject matter of Species II, Claims 2 through 21 in the reply filed on April 25, 2006 is acknowledged.

Specification

The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Objections

Claim 20 is objected to because of the following informalities: As presented Claim 20 sets forth a situation wherein the an abrasive agglomerate, ranging in size presumably from 0 to 10 micrometers ("less than 10 micrometers"), is joined or "encapsulated" with additional material to form "an erodible composite agglomerate", ranging in size from 0 to 60 micrometers ("60 micrometers or less"). In the extreme case according to the present claim language, the abrasive agglomerate can be joined with additional oxide material to form a particle of physically smaller dimensions than the abrasive agglomerates which comprise the erodible composite agglomerate. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 9 and 10 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for the manufacture of abrasive beads in the general case, does not reasonably provide enablement for the claimed spherical shaped hollow beads. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make the invention commensurate in scope with these claims. Specifically, the reference to “chemical agents” does not provide adequate disclosure to enable production of said hollow beads.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 21 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, the instant claim indicates that abrasive particles are necessarily included in an abrasive agglomerate while the parent claim suggests that said abrasive particles are present in the alternative only (eg. “the mixture solution comprising abrasive particles, an oxide, **or** a combination of oxides”). For this reason,

the particular metes and bounds for which the applicant seeks patent protection are rendered indefinite.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 2, 3, 6, 8, 11, 12, 15, and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by Berg (5,984,988). Briefly, berg teaches a method of manufacturing abrasive particles having specific, pre-determined shapes. Specifically with respect to Claim 2 Berg teaches;

1. "Providing a mold having a first surface having an opening to a mold cavity having a specified shape" (Column 2, Lines 57-58). Further, said mold should have "at least one cavity, preferably a plurality of cavities" (C6, L1-3), and should be made from a relatively thin aluminum or stainless steel sheet or belt" (C6, L6-9). It is here understood that the mold as described by Berg is equivalent to the "Cell Sheet" in the immediate claim and that the "plurality" of cavity is equivalent to the claimed array of "cell sheet through holes" which are further understood to inherently present a "cross sectional area". Further, the reference to the mold as being relatively thin indicates that said mold has a "nominal thickness". The cavities having

both a thickness and cross sectional area, inherently define a "cell sheet volume" by the product of the two aforementioned values.

2. "preparing a dispersion containing particles that can be converted into alpha alumina in a liquid, which liquid comprises a volatile component, preferably water" (C4, L55-57) and the particles are preferably alpha aluminum oxide monohydrate (boehmite) (C4, L65-66). The described dispersion is hereby understood as equivalent to the claimed "mixture solution" which is contains by an oxide, present as aluminum oxide monohydrate in the immediate context, and water.
3. "introducing the dispersion into cavities" (C6, L48-50) which is understood to be equivalent to filling the through holes with the mixture solution to form a mixture volume. Berg later makes reference to the "filled cavities in the belt" (C9, L55) which is understood to mean that the volume defined by said cavity is filled with the dispersion or alternatively that the volume of mixture solution in the mixture volume equals the cell sheet volume as claimed.
4. "removing the precursors of the abrasive particles from the mold cavities...by applying a low pressure to force them out of the cavities" (C7, L26-34). With respect to the immediate claim, the "precursors of the abrasive particles" are held equivalent to the claimed "mixture volume" before removal from the mold and to the "mixture solution lump entities" after removal from the mold. Additionally the described applied pressure

force is interpreted as being equivalent the claimed "impinging jet of fluid" used to dislocate the mixture volumes from the mold.

5. Berg further indicates that "when the precursors of the abrasive particles are removed from the mold, some of their edges may...become rounded" (C7, L40-43). This rounding effect or deformation of the precursors of the abrasive particles in the extreme case would produce an approximately spherical body and is understood to inherently occur from a force such as surface tension acting upon the body of said particle. Although presented in the immediate reference as a situation to be avoided or minimized, this disclosure is nevertheless read on the immediate claim as shaping the mixture solution lump entities into independent spherical entities through a force acting upon said lump entities.
6. "Typically, the precursors of the abrasive particles will be dried (outside of the mold" (C7, L46-58) which is held equivalent to the claimed process of subjecting the independent spherical entities to a "solidification environment" to form "loose green beads".
7. Finally, it is indicated that the precursors of the abrasive particles are sintered to form the abrasive particles (C8, L8-10) which is understood to read on the claimed process of firing the loose green beads at high temperature to form the beads.

With respect to Claim 3, Berg indicates that the precursors of the abrasive particles are to be exposed to elevated temperature air in an "air circulating oven" (C9, L56). The above disclosure is read as equivalent to providing a solidification environment comprising elevated temperature air or other gas.

Regarding Claim 6, the immediate reference indicates (C6, L8) that the mold can be made from a "belt" which is understood to be equivalent to the claimed cell sheet wherein the two opposing ends of said sheet are joined to form a cell sheet continuous belt.

Concerning Claim 8, Berg indicates in a calcining step that the precursors of the abrasive particles are "generally heated to a temperature of from about 400°C to about 800°C" (C7, L64-65). This step is followed by sintering the precursors to form the abrasive particles wherein said sintering step occurs in a temperature range from about 1000°C to about 1650°C (C8, L8-24). The applicant indicates in the specification that;

"Vitrification of the composite agglomerate or granule is avoided as the external surface of the composite would change into a continuous glassy state, thereby preventing the composite from having a porous external surface. Some example abrasive agglomerates using Aluminum oxide abrasive particles were fired at 700 degrees C. which produced a smooth, shiny agglomerate surface finish." (pg 10,

¶[0049])

It is therefore understood that the disclosed heating temperatures in the calining and sintering of the aluminum oxide particles as set forth by Berg are "sufficiently high to vitrify the bead exterior surface" and thereby producing glassy surfaces on the surface of the beads.

Further, with respect to Claim 11 Berg teaches;

8. "Providing a mold having a first surface having an opening to a mold cavity having a specified shape" (Column 2, Lines 57-58). Further, said mold should have "at least one cavity, preferably a plurality of cavities"(C6, L1-3), and should be made from a relatively thin aluminum or stainless steel sheet or belt" (C6, L6-9). It is here understood that the mold as described by Berg is equivalent to the "Cell Sheet" in the immediate claim and that the "plurality" of cavity is equivalent to the claimed array of "through holes" which are further understood to inherently present a "cross sectional area". Further, the reference to the mold as being relatively thin indicates that said mold has a "nominal thickness". The cavities having both a thickness and cross sectional area, inherently define a "cell sheet volume" by the product of the two aforementioned values of the nominal thickness and cross sectional area.
9. "preparing a dispersion containing particles that can be converted into alpha alumina in a liquid, which liquid comprises a volatile component, preferably water" (C4, L55-57) and the particles are preferably alpha aluminum oxide monohydrate (boehmite) (C4, L65-66). The described dispersion is hereby understood as equivalent to the claimed "mixture solution" which is contains by an oxide, present as aluminum oxide monohydrate in the immediate context, and water.

10. "introducing the dispersion into cavities" (C6, L48-50) which is understood to be equivalent to filling the through holes with the mixture solution to form a mixture volume. Berg later makes reference to the "filled cavities in the belt" (C9, L55) which is understood to mean that the volume defined by said cavity is filled with the dispersion or alternatively that the volume of mixture solution in the mixture volume equals the cell sheet volume as claimed.
11. "removing the precursors of the abrasive particles from the mold cavities...by applying a low pressure to force them out of the cavities" (C7, L26-34). With respect to the immediate claim, the "precursors of the abrasive particles" are held equivalent to the claimed "mixture volume" before removal from the mold and to the "mixture solution lump entities" after removal from the mold. Additionally the described applied pressure force is interpreted as being equivalent the claimed "impinging jet of fluid" used to dislocate the mixture volumes from the mold.
12. Berg further indicates that "when the precursors of the abrasive particles are removed from the mold, some of their edges may...become rounded" (C7, L40-43). This rounding effect or deformation of the precursors of the abrasive particles in the extreme case would produce an approximately spherical body and is understood to inherently occur from a force such as surface tension acting upon the body of said particle. Although presented in the immediate reference as a situation to be avoided or minimized, this

disclosure is nevertheless read on the immediate claim as shaping the mixture solution lump entities into independent spherical entities through a force acting upon said lump entities.

13. "Typically, the precursors of the abrasive particles will be dried (outside of the mold" (C7, L46-58) which is held equivalent to the claimed process of subjecting the independent spherical entities to a "solidification environment" to form "loose green agglomerates".

14. Finally, it is indicated that the precursors of the abrasive particles are sintered to form the abrasive particles (C8, L8-10) which is understood to read on the claimed process of firing the loose green agglomerates at high temperature to form the spherical abrasive agglomerates.

Claim 12 is anticipated by Berg in light of the rejection of Claim 11 and the argument set forth in the rejection of Claim 3 as presented above.

Claim 15 is anticipated by Berg in light of the rejection of Claim 11 and the argument set forth in the rejection of Claim 6 as presented above.

Claim 17 is anticipated by Berg in light of the rejection of Claim 11 and the argument set forth in the rejection of Claim 8 as presented above.

Claim Rejections - 35 USC § 103

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The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 4 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Berg (5,984,988) in light of Howard (3,916,584) and in further view of the appropriate rejections of Claims 2 and 11, respectively. As the applicant indicates in the body of the specification, the use of a dehydrating liquid in the processing of abrasive beads is commonly practiced and well known in the art;

"Presently there are a number of methods used to manufacture abrasive beads....**Among the earliest processes of making beads** is a process developed by Howard in U.S. Pat. No. 3,916,584 where he *poured a slurry mixture* (of abrasive particles mixed in a Ludox® solution of colloidal silica suspended in water) *into a dehydrating liquid* including various alcohols or alcohol mixtures or heated oils including peanut oil, mineral oil or silicone oil and stirred it." (Pg 6, ¶ {0022})

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It would have been an obvious alteration for one of ordinary skill in the art at the time of the invention to incorporate the old and well know "dehydrating liquid" process as taught by Howard to the abrasive particle manufacture process as taught by Berg. This would be an obvious modification to the Berg process in order to prevent the ejected mixture lump solution entities or independent spherical entities from agglomerating into a larger mass during while being subjected to the solidification environment.

Claims 5 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Berg (5,984,988) in light of Eisenberg (4,393,021) and in further view of the appropriate rejections of Claims 2 and 11, respectively. Berg teaches the formation of cavities in a mold belt as previously indicated and that "the cavities can extend completely through the belt, such that the belt has a multiplicity of perforations therein" (C9, L33-34), However, the immediate reference makes no indication that said belt or "cell sheet" should be a woven screen. Eisenberg teaches the fabrication of abrasive grits by pressing or extruding a composite of abrasive grits with a binding medium through a mesh screen (C2, L42-46) or "endless sieve web" (C3, L12). It would be obvious to one of ordinary skill in the art attempting to reduce equipment fabrication costs associated with manufacturing a machined mold in the manner taught by Berg to substitute an "endless sieve web" or woven screen for said mold belt as taught by Eisenberg.

Claims 7 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Berg (5,984,988) in light of Culler (6,521,004) and the Quadro Engineering Incorporated Quadro® Comil® product description

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(http://www.quadro.com/3_milling/3_applications.asp) and in further view of the appropriate rejections of Claims 2 and 11, respectively. Berg teaches of a belt shaped mold device for use in the manufacture of agglomerate abrasive particles. The immediate reference however fails to explicitly indicate that the mold should take the form of a disk shape having an annular pattern of cell sheet holes. Culler teaches of a perforated substrate (see Fig 4 excerpt below), broadly understood to be of a conical disk shape and presenting an annular pattern of cell sheet holes. Further by Cullers teachings, this perforated substrate is utilized in the fabrication of abrasive agglomerate particles. The particular apparatus presented by Culer is manufactured by Quadro Engineering Incorporated and is reported by said manufacturer to minimize blockages in the screen or perforations.



Claims 9 and 10 rejected under 35 U.S.C. 103(a) as being unpatentable over Berg (6,521,004) in view of Matthews (3,838,998) and in further view of the rejection of Claim 2 above. Specifically with respect to Claim 9, Berg discloses all of the elements of Claim 2 while failing to explicitly indicate that a chemical agent should be

incorporated into the mixture solution to provide spherical shaped hollow beads.

Matthews teaches of a process incorporating both high and low temperature glass formers in an admix with water to form a slurry. Upon performing a dual heating cycle first at low temp which bloats the low temp glass former and then at high temperature which vitrifies the outer shell, Matthews prepares a hollow, spherical, and vitrified particle. In the instant case, the low temperature glass former could be considered a "chemical agent" in the admix which provides for hollow particles. Matthews further indicates that "hollow microspheres are particularly advantageous as they contribute stiffness and strength yet often permit a reduction in weight of the ultimate product because of their stiffness and strength in proportion to their density" (C1, L26-31). It would be obvious to one of ordinary skill in the art seeking to prepare a hollow abrasive particle to incorporate a low temperature glass former into the mixture volume according to the teachings of Matthews into the process as outlined by Berg. The preparation of a hollow abrasive of the type taught by the Berg-Matthews combination would be obvious to one seeking to retain the stiffness and abrasive properties of the abrasive particles while minimizing the particle density and therefore product weight.

Regarding Claim 10 and in light of the Claim 9 Rejection above, Berg indicates that the calcinated precursor particles are to be subjected to a temperature sufficient to sinter the particles as outlined in Claim 2 above. This disclosure is read in the immediate claim as firing the hollow beads at a temperature sufficiently high to vitrify the agglomerate exterior surfaces of said beads thereby resulting in glassy surfaces on said vitrified beads.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Berg (5,984,988) as applied to Claim 11 and in further view of Cai et. al. (Phys Rev Lett. 2002 Dec 2;89(23):235501.) Specifically, Berg sets forth the composition of the dispersion as "containing particles that can be converted into alpha alumina in a liquid" while failing to explicitly indicate the said dispersion should necessarily contain at least one material from the indicated group. Cai indicates that "gamma-alumina is known to transform to theta-alumina and finally to alpha-alumina upon thermal treatment". It would therefore be obvious to one of ordinary skill to choose gamma-alumina as taught by Cai or "alumina" from the immediate list for the particle that can be converted into alpha alumina in the thermal treatment process set forth by Berg.

Claim 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Berg (5,984,988) as applied to Claim 11 above and in further view of Culler (6,521,004).

With respect to Claim 19 and as indicated above, Berg teaches all of the elements of Claim 11 as well as indicating that, "the shaped particles of (the Berg) invention continually fracture to expose fresh cutting surfaces" (C3, L42-44). Accordingly, they may be considered in the present context to be an erodible matrix material. Berg further indicates that said abrasive particles can be combined with cubic boron nitride or diamond in an adhesive coating layer when preparing an abrasive article (C11, L10-20). Berg however fails to indicate that diamond or cubic boron nitride particles should be directly incorporated into the spherical abrasive agglomerates and bound in an erodible matrix material. Culler teaches a method of forming abrasive agglomerate particles by encapsulating abrasive grains in an erodible binder agent.

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Among the acceptable abrasive grains indicated as being preferred for the immediate process include aluminum oxide, diamond, and cubic boron nitride (C2, L1-12). It is further indicated that incorporating said abrasive grains in the erodible matrix enhances the useful life of a coated abrasive article (C1, L29-31). It would therefore be obvious to one of ordinary skill in the art seeking to enhance the useful life of an abrasive article to directly incorporate oxides, cubic boron nitride or diamond directly into the erodible matrix material or the shaped particles of the Berg invention according to the teachings of Culler.

Regarding Claim 20, Berg indicates that "the thickness of the particles preferably range from about 25 micrometers to 500 micrometers" (C11, L5-7) and that they may further have an aspect ratio of 1:1 with respect to their thickness (C3, L34-38). This disclosure is understood as providing abrasive agglomerates having number average abrasive particle diameter sizes in the range of about 25 to 500 micrometers. This disclosure alone is understood as providing abrasive agglomerates in the approximate size range of 10 micrometers as indicated in the immediate claim limitation. As further indicated above in the Claim 19 rejection, Berg indicates that the abrasive agglomerates can be encapsulated with aluminum oxide or "oxide materials" and an adhesive to form an erodible composite film on an abrasive article. Berg fails to *explicitly* set forth that the abrasive agglomerates should have diameters less than 10 micrometers or that the erodible composite should be in the form of particles with diameter of less than 60 micrometers.

Culler teaches that the erodible agglomerate particles, discussed in the rejection of Claim 19 above, have a length dimension in the range of about 10 to about 1500 micrometers (C20, L43-46) and consist principally of abrasive particles in an erodible binder. This disclosure is understood to provide for erodible agglomerate particles in the size range of less than or equal to 60 micrometers as set forth in the immediate claim. Further, since the erodible agglomerate dimension must be equal to or larger than the abrasive particle constituents, said abrasive particles must be of a size range less than or equal to 10 micrometers for erodible agglomerate particles on the lower end of the size range. Given that Culler sets forth abrasive particle dimensions and erodible abrasive agglomerate dimensions in the range of the immediately claimed invention, said dimensions are considered to be routinely employed in the art. It would therefore be obvious to adapt Berg process to produce abrasive agglomerates and erodible composite agglomerates in the size range taught by Culler as appropriate for the end user application

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Berg (5,984,988) as applied to Claim 11 above and in further view Ramanath (5834,569). Berg teaches all of the elements of Claim 11 while failing to indicate that coloring agents should be incorporated into the abrasive agglomerates in order to identify the particle size of the abrasive particles contained in said abrasive agglomerate. Ramanath teaches a grinding wheel "can be colored according to a predetermined color coding scheme to identify particle size, shape and type of abrasive" (C2, L31-33). It would therefore be obvious to one of ordinary skill in the art to incorporate a color-coding


scheme as taught by Ramanath to abrasive particles of the Berg process in order to prevent the use of an incorrect abrasive particle size.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason L. Lazorcik whose telephone number is (571) 272-2217. The examiner can normally be reached on Monday through Friday 8:30 am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Griffin can be reached on (571) 272-1189. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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